SCALING UP GRAPHENE PET NANO-COMPOSITES FOR INDUSTRY APPLICATIONS

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Graphene nanocomposites have offered promise to benefit manufactured goods and their packaging materials for over a decade. The promise includes improving thermal properties for processing, increased specific strength, enhanced barrier properties, and electrical conductivity. Often such improvements have a potential for implementation with very little change in industry standard processing equipment. As commodity and energy costs rise, efficient product design becomes increasingly important. Shipping and material costs have risen to a larger, and often leading, fraction of manufacturer's total costs. Simply using less material means less weight, which both reduces raw material and transportation costs. However, this is only possible if the new design performance meets or exceeds market needs. An additional benefit of material reduction is a reduced impact on the environment. Some specific examples of environmental impact reduction from the use of graphene based nanocomposites were recently measured at 30%. In that case, the thermal properties provided the most significant benefit, allowing processing using less energy. There also appears to be benefit in recycling graphene-PET nano-composites over other additives in the recycle stream. Mechanical property enhancement from graphene nanocomposites remains the most important benefit for manufacturing.

The promise of graphene nanocomposites to provide the lightweight high performance alternative to 20th century materials still stands. However, adaptation of nanocomposites in day-to-day applications outside the laboratory at industrial scale are lagging due to limitations with dispersing the nano-phase. A new approach of dosing nano-phase materials dispersed in a liquid medium during industry compatible molding processes can deliver the intended level of property improvements. This new method and resulting property improvements are discussed with examples including: improved thermal conductivity from graphene dispersed through melt mixing and liquid dosing; exfoliated graphene obtained through liquid dispersion improving the elastic modulus without impacting film clarity; and methods to track dosing consistency or quantifying dispersion level. These all indicate an effective exfoliation fraction exists which improves the composite properties.